Claims

1 Apparatus for the application of a coating of material or materials, said coating comprising at least first and second layers of material or material compositions, said apparatus including at least first and second magnetrons from which material can be selectively applied, a substrate holder, on which the substrates to be coated are held and characterised in that positioned between the magnetrons and the substrate holder, is at least one shield, said shield including at least one aperture through which material deposited from a magnetron can pass for application onto the substrates when the aperture is suitably positioned with respect to the said magnetron and substrate holder by selective rotation of the shield with respect to the magnetrons so as to define a passage through which the material deposited from the target of said magnetron can pass.

2 Apparatus according to claim 1 characterised in that the movement of the shield in use means that when the aperture or any part of the aperture is not in front of a particular magnetron, deposition of the material onto the substrates from that magnetron is prevented or at least significantly reduced.

3 Apparatus according to claim 1 characterised in that the shield is rotatable so that the aperture moves from a position in front of a first magnetron to a position in front of a second magnetron and so on in sequence to provide a multi layered coating.

4 Apparatus according to claim 3 characterised in that a coating with alternate layers of materials from the targets of the first and second magnetrons is achieved.

5 Apparatus according to claim 1 characterised in that the thickness of the individual layers of material is controlled by the power applied to the magnetron and/or the time of a shield aperture being positioned in front of that particular magnetron.

6 Apparatus according to claim 1 characterised in that a closed field unbalanced magnetron (CFUBM) configuration is used.

7 Apparatus according to claim 1 characterised in that the substrates are mounted on the holder which is rotatable.

8 Apparatus according to any of claims 1-8 characterised in that the shield is replaced by two shields with one positioned inside the other, having a common axis of rotation and each having at least one aperture therein.

9 Apparatus according to any of the preceding claims wherein the shield(s) is/are cylindrical and concentric with the substrate holder, and rotate about a common axis of rotation.

10 Apparatus according to claim 9 characterised in that the shields are selectively rotated to bring the apertures in each into line and define a passage for the deposition of material from a magnetron target therethrough when positioned in front of said target.

11 Apparatus according to claim 9 characterised in that the shields are selectively positioned so as to prevent material passing through the apertures and onto the substrates during the preparation of the magnetron targets.

12 A method for controlling the application of a multilayered coating onto at least one substrate in a coating chamber, said

method comprising positioning a plurality of magnetrons with targets of material to be deposited in the coating chamber to face towards a substrate holder in the chamber, interposing between the substrate holder and the magnetrons, first and second shields, providing in said shields at least one aperture which, when selectively positioned with respect to a magnetron, allows material deposited from the magnetron target to pass therethrough and onto the substrates and characterised in that the shields are selectively rotatable so as to move and position the respective apertures to define a passage for selected periods of time to allow the passage of material deposited from a magnetron target and then to move the shields to repeat the same as required with respect to the first and second magnetrons as required to apply the multilayered coating onto the substrates.

13 A method according to claim 12 characterised in that the magnetrons are continuously operated during the deposition process to deposit material from the respective target and when the apertures of the shields are not positioned to define a passage for the material the deposited material applies to the wall of the shield which faces the target.

14 A method according to claim 12 wherein when no passage is defined by the shield apertures at a particular magnetron at a particular time during the coating procedure that magnetron can be moved to a shut down or standby condition.

15 A method according to claim 12 characterised in that the movement of one or both of the shields is continuous at a selected speed which can be varied or fixed to suit particular coating requirements.

16 A method according to claim 12 characterised in that the movement of one or both of the shields is stepwise with a selected dwell time of the shields to allow a blanking of the passage of deposited material to the substrates or deposition of material from a target or targets for a period of time.

17 A method according to claim 16 characterised in that the shields are selectively moved between dwell times to define the blanking or deposition passage configurations as required.

18 A method according to any of claims 12-17 wherein a reactive gas is introduced into the coating chamber during the coating procedure to allow the deposited material to form a compound material on the substrates.

19 A method according to claim 12 characterised in that the method includes the step of conditioning or preparing the material targets in each of the magnetrons prior to operation of the shields to form deposition passages, during which preparation stage material is deposited from the magnetron targets and the shields are positioned to prevent material from the targets reaching the substrates.

20 A method according to claim 12 characterised in that the relative positions of the shields when forming a passage for the deposited material from a magnetron target are selected to define the width of the passage defined by the apertures.

21 A method according to claim 20 wherein the apertures are positioned in line to define a full width passage.

22 A method according to claim 20 wherein the apertures are offset or of differing widths to define a passage of a width less than the width of the largest width aperture.

23 A method for the control of operation of apparatus for applying a coating onto at least one substrate, said coating comprising a series of layers and said apparatus including within a coating chamber at least two magnetrons for the selective deposition of material from magnetron targets onto the substrates, and a plurality of cylindrical shields positioned between the targets and the substrate holder, said shields including apertures which can be selectively positioned to define a passage for deposited material from the targets onto the substrates and characterised in that the method comprises the steps of:-

preparing the targets by operating the magnetrons to deposit material from the targets in the coating chamber and positioning the shields to prevent the passage of deposited material onto the substrates; and
applying a predetermined power level to the magnetrons and maintaining said power level during the application of the deposited material onto the substrates and the apertures in the shields are selectively positioned to allow the selective application of the material onto the substrates through passages defined by the apertures.

24 A method according to claim 23 wherein the deposition of material is to be by reactive deposition and a reactive gas is introduced into the coating chamber to a defined level after the magnetron target preparation steps have been completed.

25 A method according to claim 24 wherein when the appropriate gas level is reached and maintained, the apertures in the shields are selectively positioned to allow the selective application of the material onto the substrates through passages defined by the apertures.

26 A method according to claim 24 wherein the defined level of reactive gas is selected with reference to the metal intensity of the target as cleaned and prepared which is regarded as 100%.

27 A method according to claim 24 wherein monitoring means are provided in the coating chamber and when the appropriate gas level is reached to match a predetermined value the same is monitored for a period of time to ensure the same is stable and if so the gas continues to flow at that same rate.

28 A method according to claim 27 wherein a gas control method is used including any of magnetron power supply voltage variation or mass spectrometer control of gas partial pressures.

29 A method according to claim 27 wherein Optical emission monitoring (OEM) is used to control the gas flow.

30 A method according to claim 29 wherein OEM is used to control the reactive gas flow at the required level for a stoichiometric coating to be applied to the substrates.

31 A method according to any of claims 24-30 wherein the power level applied to the magnetrons during the preparation stage is higher than that applied during the material deposition.

32 A method according to claim 24 wherein stable operating conditions are established prior to the deposition of the material onto the substrates by enabling the preparation and cleaning of the targets without contaminating the substrates by positioning the shields to prevent the passage pf the material onto said substrates during the preparation stage.